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(54) Title: USE OF MACROLIDE COMPOUNDS FOR THE TREATMENT OF DRY EYE

(57) Abstract

The present invention provides an agent for treating a dry eye, which contains a macrolide compound such as FK506.

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SPECIFICATION

USE OF MACROLIDE COMPOUNDS FOR THE TREATMENT OF DRY EYE

Technical Field

The present invention relates to an agent for treating a dry eye.

Background Art

One of the symptoms of ophthalmic diseases drawing much attention these days is dry eye. The dry eye is defined to mean a condition wherein lacrimal fluid is less in amount or abnormal in quality, with or without the presence of corneal and conjunctival lesion (Yamada, M. et al., Folia Ophthalmol. Jpn., 43, 1289-1293 (1992)). Specific symptoms include dry eye observed in hypolacrimation, alacrima, xerophthalmia, Sjögren syndrome, keratoconjunctivitis sicca, Stevens-Johnson syndrome, ocular pemphigoid, marginal blepharitis, diabetes and the like, dry eye observed after cataract operation, dry eye in conjunction with allergic conjunctivitis and the like, and dry eye due to hypolacrimation caused by increased VDT (visual display terminal) work, dry room with air conditioning and the like.

The dry eye is caused by various factors that may not be entirely clear, and, at the moment, a drastic treatment method, such as promotion of the secretion of lacrimal fluid, has not been established yet. Therefore, the dry eye has been diagnosed according to the subjective symptoms obtained by questioning and objective symptoms known from lacrimal fluid evaluation tests (tear film breakup time, Schirmer test, lacrimal fluid clearance test and the like), corneal and conjunctival staining tests (fluorescein staining, rose bengale staining and the like), and the like. For example, tear film breakup time (BUT), which is one of the lacrimal fluid evaluation tests, reflects the stability of precorneal tear film, and means the time (sec) from complete nictitation to the initial breakage of the precorneal tear film. A lower BUT means severer dry eye symptom. In the case of severe dry eye, the breakage of the tear film occurs immediately after nictitation, which is rated as BUT zero (0) sec.

At present, a dry eye therapy includes increasing lacrimal fluid reservoir in conjunctival sac by instillation of artificial tears to alleviate the subjective symptoms of patients or to protect the eye from drying, and other methods.

For the above-mentioned therapy, instillation of chondroitin

sulfate, methyl cellulose and the like, and internal use of bromhexine hydrochloride, salivary gland hormone and the like have been the typical methods. However, the effect of such therapy is not necessarily satisfactory. While instillation of artificial tears and use of a goggle eye patch and the like have been the means to protect the eyes from drying, these are not more than auxiliary therapy methods.

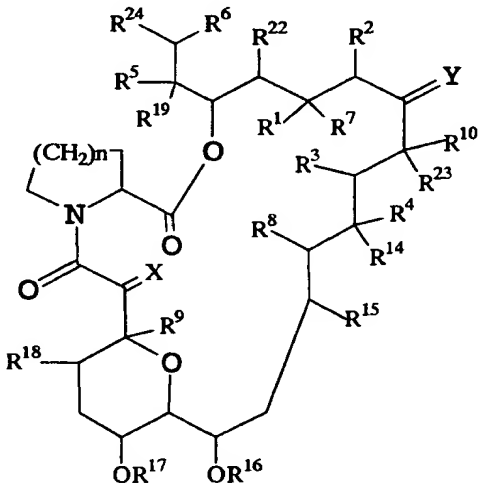
DISCLOSURE OF THE INVENTION

As a result of the intensive studies done by the present inventor, it was surprisingly found that a macrolide compound has a superior improving effect on dry eye symptoms, particularly subjective symptoms, and in lacrimal fluid evaluation tests, such as tear film breakup time and the like, and exhibits a superior therapeutic effect on the dry eye, which resulted in the completion of the present invention.

Accordingly, the present invention provides the following.

(1) An agent for treating a dry eye, comprising a macrolide compound as an active ingredient.

(2) The agent of (1), wherein the macrolide compound is a tricyclo compound (I) of the following formula



(I)

wherein adjacent pairs of R^1 and R^2, R^3 and R^4, and R^5 and R^6 each independently

a) consist of two adjacent hydrogen atoms, wherein R^2 is optionally alkyl, or

b) form another bond between carbon atoms binding with the members of each pair ;

R^7 is hydrogen atom, hydroxy, alkyloxy or protected hydroxy, or may

form oxo with R^1 ;

R^8 and R^9 each independently show hydrogen atom or hydroxy ;

R^{10} is hydrogen atom, alkyl, alkenyl, alkyl substituted by one or more hydroxy, alkenyl substituted by one or more hydroxy, or alkyl substituted by oxo ;

X is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $-CH_2O-$;

Y is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $N-NR^{11}R^{12}$ or $N-OR^{13}$;

R^{11} and R^{12} each independently show hydrogen atom, alkyl, aryl or tosyl ;

R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{22} and R^{23} each independently show hydrogen atom or alkyl ;

R^{24} is an optionally substituted ring that may contain one or more hetero atom(s) ; and

n is 1 or 2.

In addition to the meaning noted above, Y, R^{10} and R^{23} may form, together with the carbon atom they bind with, a saturated or unsaturated 5 or 6-membered heterocyclic group containing nitrogen atom, sulfur atom and/or oxygen atom, wherein the heterocyclic group may be substituted by one or more group(s) selected from the group consisting of alkyl, hydroxy, alkyloxy, benzyl, a group of the formula $-CH_2Se(C_6H_5)$, and alkyl substituted by one or more hydroxy,

or a pharmaceutically acceptable salt thereof.

(3) The agent of (1) or (2), wherein the macrolide compound is FK506.

(4) The agent of any of (1) to (3), which is in the form of a preparation for local administration to the eye.

(5) The agent of any of (1) to (4), which aims at improving the tear film breakup time.

(6) A method for treating dry eye, comprising administering an effective amount of a macrolide compound to a subject in need of the treatment of dry eye.

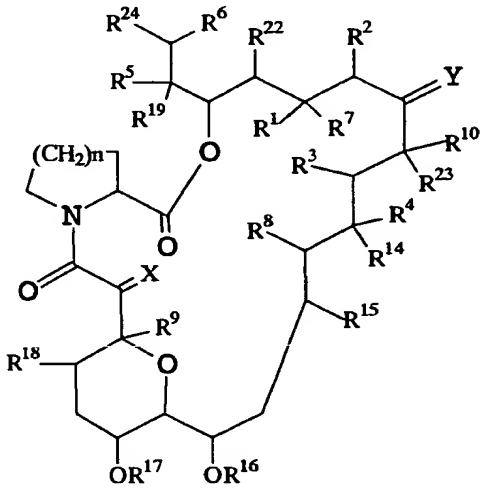
(7) Use of a macrolide compound for the production of a pharmaceutical composition for the treatment of dry eye.

DETAILED DESCRIPTION OF THE INVENTION

Some of the macrolide compounds to be used in the present invention are known as shown below and a novel macrolide compound can be prepared from these known macrolide compounds by a known method. Preferable examples thereof include macrolide compounds such as FK506, Ascomycin

derivative, Rapamycin derivative and the like.

Specific examples of macrolide compound include tricyclo compound (I) of the following formula and a pharmaceutically acceptable salt thereof.



(I)

wherein adjacent pairs of R^1 and R^2, R^3 and R^4, and R^5 and R^6 each independently

a) consist of two adjacent hydrogen atoms, wherein R^2 is optionally alkyl, or

b) form another bond between carbon atoms binding with the members of each pair;

R^7 is hydrogen atom, hydroxy, alkyloxy or protected hydroxy, or may form oxo with R^1;

R^8 and R^9 each independently show hydrogen atom or hydroxy;

R^{10} is hydrogen atom, alkyl, alkenyl, alkyl substituted by one or more hydroxy, alkenyl substituted by one or more hydroxy, or alkyl substituted by oxo;

X is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $-CH_2O-$;

Y is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $N-NR^{11}R^{12}$ or $N-OR^{13}$;

R^{11} and R^{12} each independently show hydrogen atom, alkyl, aryl or tosyl;

R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{22} and R^{23} each independently show hydrogen atom or alkyl;

R^{24} is an optionally substituted ring that may contain one or more hetero atom(s); and

n is 1 or 2.

In addition to the meaning noted above, Y, R^{10} and R^{23} may form, together with the carbon atom they bind with, a saturated or unsaturated 5 or 6-membered heterocyclic group containing nitrogen atom, sulfur atom and/or oxygen atom, wherein the heterocyclic group may be substituted by one or more group(s) selected from the group consisting of alkyl, hydroxy, alkyloxy, benzyl, a group of the formula $-CH_2Se(C_6H_5)$, and alkyl substituted by one or more hydroxy.

Preferable R^{24} is, for example, cyclo(C_5-C_7)alkyl optionally having suitable substituent, such as the following.

(a) 3,4-dioxocyclohexyl,

(b) 3-R^{20}-4-R^{21}-cyclohexyl,

wherein R^{20} is hydroxy, alkyloxy or $-OCH_2OCH_2CH_2OCH_3$, and R^{21} is hydroxy, -OCN, alkyloxy, heteroaryloxy optionally having suitable substituent, $-OCH_2OCH_2CH_2OCH_3$, protected hydroxy, chloro, bromo, iodo, aminooxalyloxy, azide, p-tolyloxythiocarbonyloxy, or $R^{25}R^{26}CHCOO$- (wherein R^{25} is hydroxy optionally protected where desired or protected amino, and R^{26} is hydrogen atom or methyl),

or R^{20} and R^{21} in combination form an oxygen atom of epoxide ring, and

(c) cyclopentyl substituted by methoxymethyl, protected hydroxymethyl where desired, acyloxymethyl (wherein acyl moiety is optionally quaternized dimethylamino where desired or optionally esterified carboxy), one or more optionally protected amino and/or hydroxy, or aminooxalyloxymethyl. Preferable example includes 2-formyl-cyclopentyl.

The definition of each symbol used in the formula (I), specific examples thereof and preferable embodiments thereof are explained in detail in the following.

"Lower" means that a group has 1 to 6 carbon atoms unless otherwise indicated.

Preferable examples of "alkyl" and the alkyl moiety of "alkyloxy" include linear or branched aliphatic hydrocarbon residue, such as lower alkyl (e.g., methyl, ethyl, propyl, isopropyl, butyl, isobutyl, pentyl, neopentyl, hexyl and the like).

Preferable examples of "alkenyl" include linear or branched aliphatic hydrocarbon residue having one double bond, such as lower alkenyl (e.g., vinyl, propenyl (e.g., allyl and the like), butenyl, methylpropenyl, pentenyl, hexenyl and the like).

Preferable examples of "aryl" include phenyl, tolyl, xylyl,

cumenyl, mesityl, naphthyl and the like.

Preferable examples of the protective group of "protected hydroxy" and "protected amino" include 1-(lower alkylthio)(lower)alkyl such as lower alkylthiomethyl (e.g., methylthiomethyl, ethylthiomethyl, propylthiomethyl, isopropylthiomethyl, butylthiomethyl, isobutylthiomethyl, hexylthiomethyl and the like), with more preference given to C_1 - C_4 alkylthiomethyl and most preference given to methylthiomethyl;

tri-substituted silyl such as tri(lower)alkylsilyl (e.g., trimethylsilyl, triethylsilyl, tributylsilyl, tert-butyldimethylsilyl, tri-tert-butylsilyl and the like), and lower alkyldiarylsilyl (e.g., methyldiphenylsilyl, ethyldiphenylsilyl, propyldiphenylsilyl, tert-butyldiphenylsilyl and the like, with more preference given to tri(C_1-C_4)alkylsilyl and C_1-C_4 alkyldiphenylsilyl, and most preference given to tert-butyldimethylsilyl, tert-butyldiphenylsilyl;

acyl such as aliphatic acyl derived from carboxylic acid, sulfonic acid and carbamic acid, aromatic acyl, and aliphatic acyl substituted by aromatic group; and the like.

The aliphatic acyl is exemplified by lower alkanoyl optionally having one or more suitable substituent(s) (e.g., carboxy) such as formyl, acetyl, propionyl, butyryl, isobutyryl, valeryl, isovaleryl, pivaloyl, hexanoyl, carboxyacetyl, carboxypropionyl, carboxybutyryl, carboxyhexanoyl and the like;

cyclo(lower)alkyloxy(lower)alkanoyl optionally having one or more suitable substituent(s) (e.g., lower alkyl) such as cyclopropyloxyacetyl, cyclobutyloxypropionyl, cycloheptyloxybutyryl, mentyloxyacetyl, mentyloxypropionyl, mentyloxybutyryl, mentyloxypentanoyl, mentyloxyhexanoyl and the like, camphorsulfonyl;

lower alkylcarbamoyl having one or more suitable substituent(s) such as carboxy or protected carboxy and the like, such as carboxy(lower)alkylcarbamoyl (e.g., carboxymethylcarbamoyl, carboxyethylcarbamoyl, carboxypropylcarbamoyl, carboxybutylcarbamoyl, carboxypentylcarbamoyl, carboxyhexylcarbamoyl) and

tri(lower)alkylsilyl(lower)alkyloxycarbonyl(lower)-alkylcarbamoyl (e.g., trimethylsilylmethoxycarbonylethylcarbamoyl, trimethylsilylethoxycarbonylpropylcarbamoyl,

triethylsilylethoxycarbonylpropylcarbamoyl, tert-butyldimethylsilylethoxycarbonylpropylcarbamoyl, trimethylsilylpropoxycarbonylbutylcarbamoyl); and the like.

Aromatic acyl is exemplified by aroyl optionally having suitable substituent(s) (e.g., nitro), such as benzoyl, toluoyl, xyloyl, naphthoyl, nitrobenzoyl, dinitrobenzoyl, nitronaphthoyl and the like ; and arenesulfonyl optionally having one or more suitable substituent(s) (e.g., halogen), such as benzenesulfonyl, toluenesulfonyl, xylenesulfonyl, naphthalenesulfonyl, fluorobenzenesulfonyl, chlorobenzenesulfonyl, bromobenzenesulfonyl, iodobenzenesulfonyl and the like.

The aliphatic acyl substituted by aromatic group may be, for example, ar(lower)alkanoyl optionally having one or more suitable substituent(s) (e.g., lower alkyloxy or trihalo(lower)alkyl and the like), wherein specific examples are phenylacetyl, phenylpropionyl, phenylbutyryl, 2-trifluoromethyl-2-methoxy-2-phenylacetyl, 2-ethyl-2-trifluoromethyl-2-phenylacetyl, 2-trifluoromethyl-2-propoxy-2-phenylacetyl and the like.

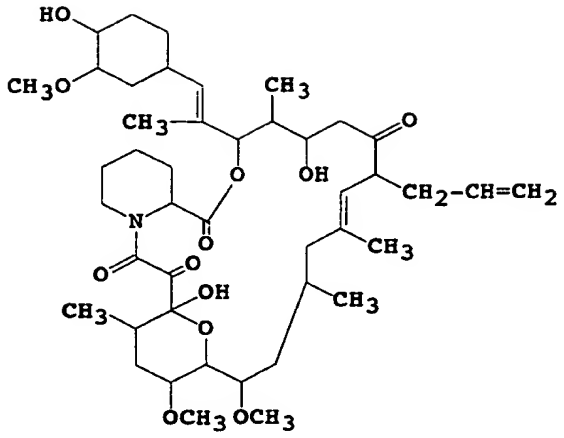
Of the above-mentiond acyl, more preferable acyl includes C_1 - C_4 alkanoyl optionally having carboxy, cyclo(C_5 - C_6)alkyloxy(C_1 - C_4)alkanoyl having two (C_1 - C_4)alkyl in the cycloalkyl moiety, camphorsulfonyl, carboxy (C_1 - C_4)alkylcarbamoyl, tri(C_1 - C_4)alkylsilyl(C_1 - C_4)alkyloxycarbonyl(C_1 - C_4)alkylcarbamoyl, benzoyl optionally having 1 or 2 nitro groups, benzenesulfonyl having halogen, and phenyl(C_1 - C_4)alkanoyl having C_1 - C_4 alkyloxy and trihalo(C_1 - C_4)alkyl. Of these, most preferred are acetyl, carboxypropionyl, mentyloxyacetyl, camphorsulfonyl, benzoyl, nitrobenzoyl, dinitrobenzoyl, iodobenzenesulfonyl, 2-trifluoromethyl-2-methoxy-2-phenylacetyl and the like.

Preferable examples of the "heterocyclic group consisting of saturated or unsaturated 5 or 6-membered ring having nitrogen atom, sulfur atom and/or oxygen atom" are pyrolyl, tetrahydrofuryl and the like.

The "heteroaryl optionally having a suitable substituent" moiety of the "heteroaryloxy optionally having a suitable substituent" is that exemplified for R^1 of the compound of the formula I of EP-A-532,088, with preference given to 1-hydroxyethylindol-5-yl. This publication is incorporated hereinto by reference.

The tricyclo compound (I) and a pharmaceutically acceptable salt thereof to be used in the present invention have immunosuppressive action, antibacterial action and other pharmacological activity, so that they are useful for the prophylaxis and treatment of rejection in organ or tissue transplantation, graft versus host reaction, autoimmune diseases, infectious diseases and the like, as noted, together with the production method thereof, in, for example, EP-A-184162, EP-A-323042, EP-A-423714, EP-A-427680, EP-A-465426, EP-A-480623, EP-A-532088, EP-A-532089, EP-A-569337, EP-A-626385, WO89/05303, WO93/05058, WO96/31514, WO91/13889, WO91/19495, WO93/5059 and the like, all of these publications are hereby incorporated by reference.

In particular, the compounds called FR900506 (=FK506), FR900520 (Ascomycin), FR900523 and FR900525 are produced by the genus *Streptomyces*, such as *Streptomyces tsukubaensis*, No. 9993 (depository : National Institute of Bioscience and Human-Technology Agency of Industrial Science and Technology, the Ministry of International Trade and Industry, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki-ken, Japan (formerly : Fermentation Research Institute, Agency of Industrial Science and Technology, the Ministry of International Trade and Industry), date of deposit : October 5, 1984, deposit number : FERM BP-927) or *Streptomyces hygroscopicus subsp. Yakushimaensis*, No. 7238 (depository : National Institute of Bioscience and Human-Technology Agency of Industrial Science and Technology, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki-ken, Japan (formerly : Fermentation Research Institute, Agency of Industrial Science and Technology, the Ministry of International Trade and Industry), date of deposit : January 12, 1985, deposit number : FERM BP-928 (EP-A-0184162)). The compound of the following formula, FK506 (general name : Tacrolimus), is a representative compound.



Chemical name : 17-allyl-1,14-dihydroxy-12-[2-(4-hydroxy-3-methoxycyclohexyl)-1-methylvinyl]-23,25-dimethoxy-13,19,21,27-tetramethyl-11,28-dioxa-4-azatricyclo-[22.3.1.$0^{4,9}$]octacos-18-ene-2,3,10,16-tetraone

Of the tricyclo compounds (I), more preferred is a compound wherein adjacent pairs of R^3 and R^4, and R^5 and R^6 each independently form another bond between carbon atoms binding with the members of each pair ;

R^8 and R^{23} each independently show hydrogen atom ;

R^9 is hydroxy ;

R^{10} is methyl, ethyl, propyl or allyl ;

X is (hydrogen atom, hydrogen atom) or oxo ;

Y is oxo ;

R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19} and R^{22} each independently show methyl ;

R^{24} is 3-R^{20}-4-R^{21}-cyclohexyl,

wherein R^{20} is hydroxy, alkyloxy or $-OCH_2OCH_2CH_2OCH_3$, and

R^{21} is hydroxy, -OCN, alkyloxy, heteroaryloxy optionally having suitable substituent, $-OCH_2OCH_2CH_2OCH_3$, protected hydroxy, chloro, bromo, iodo, aminooxalyloxy, azide, p-tolyloxythiocarbonyloxy or $R^{25}R^{26}CHCOO-$ (wherein R^{25} is hydroxy optionally protected where desired, or protected amino, and R^{26} is hydrogen atom or methyl), or R^{20} and R^{21} in combination form an oxygen atom of epoxide ring; and

n is 1 or 2.

Particularly preferable tricyclo compound (I) includes, besides FK506, Ascomycin derivatives such as halogenated derivative of 33-epi-chloro-33-desoxy Ascomycin described in Example 66a of

EP-A-427,680 and the like.

Other preferable macrolide compounds include Rapamycin described in MERCK INDEX, 12 edition, No. 8288 and derivatives thereof. Preferable examples thereof include O-substituted derivative described at page 1 of WO95/16691, formula A, wherein the 40th hydroxy is -OR_1 (wherein R_1 is hydroxyalkyl, hydroalkyloxyalkyl, acylaminoalkyl or aminoalkyl), such as 40-O-(2-hydroxy)ethyl Rapamycin, 40-O-(3-hydroxy)propyl Rapamycin, 40-O-[2-(2-hydroxy)ethoxy]ethyl Rapamycin and 40-O-(2-acetaminoethyl) Rapamycin. These O-substituted derivatives can be produced by reacting, under appropriate conditions, Rapamycin (or dihydro or deoxo Rapamycin) and an organic radical bound with a leaving group (e.g., RX wherein R is an organic radical desirable as O-substituent, such as alkyl, allyl and benzyl moiety, and X is a leaving group such as $CCl_3C(NH)O$ and CF_3SO_3)). The conditions are: when X is $CCl_3C(NH)O$, acidic or neutral conditions, such as in the presence of trifluoromethanesulfonic acid, camphorsulfonic acid, p-toluenesulfonic acid or their corresponding pyridinium or substituted pyridinium salt, and when X is CF_3SO_3, in the presence of a base such as pyridine, substituted pyridine, diisopropylethylamine and pentamethylpiperidine. The most preferable Rapamycin derivative is 40-O-(2-hydroxy)ethyl Rapamycin as disclosed in WO94/09010. The contents of the above references are hereby incorporated into the specification by reference.

The pharmaceutically acceptable salt of tricyclo compound (I), Rapamycin and derivatives thereof are nontoxic and pharmaceutically acceptable conventional salts, which are exemplified by salts with inorganic or organic base such as alkali metal salt (e.g., sodium salt, potassium salt and the like), alkaline earth metal salt (e.g., calcium salt, magnesium salt and the like), ammonium salt, and amine salt (e.g., triethylamine salt, N-benzyl-N-methylamine salt and the like).

In the macrolide compound of the present invention, conformer or one or more pairs of stereoisomers, such as optical isomers and geometric isomers, may be included due to asymmetric carbon atom and double bond. Such conformers and isomers are also encompassed in the present invention. In addition, macrolide compounds can form solvates, which case is also encompassed in the present invention. Preferable solvate is exemplified by hydrates and ethanolates.

The diseases associated with dry eye in the present invention

include those mentioned above inclusive of hypolacrimation, alacrima xerophthalmia, Sjögren syndrome, keratoconjunctivitis sicca, Stevens-Johnson syndrome, ocular pemphigoid, marginal blepharitis, diabetes and the like, dry eye observed after cataract operation, that in conjunction with allergic conjunctivitis and the like. The dry eye similar to hypolacrimatioin is also observed, which is caused by VDT work and dry room due to air conditioning and the like.

The treatment agent of the present invention is effective against the above-mentioned dry eye and for the improvement of subjective symptoms, particularly dry eye, and in evaluation of tears, such as tear film breakup time (BUT) and the like.

The treatment in the context of the present invention includes any management such as prevention, cure, alleviation of symptom, reduction of symptom, prevention of progression and the like.

The macrolide compound to be used in the present invention can be used as a pharmaceutical agent for human and animals, and can be administered systemically or locally by oral administration, intravenous administration (inclusive of transfusion), subcutaneous administration, rectal or virginal administration, administration to local site in the eye (inclusive of eye ointment). In consideration of systemic influence, significant expression of the effect and the like, it is particularly preferably used in the form for local administration to the eye.

The dose of the macrolide compound varies depending on the kind, age, body weight of the administration subject such as human and animal, conditions to be treated, desired therapeutic effect, administration method, treatment period and the like. Generally, when it is administered systemically, the dose is about 0.0001 - 1000 mg, preferably 0.001 - 500 mg, which is given in a single dose or 2 to 4 dividual doses a day or administered in a sustained manner. When it is administered locally to the eye, a preparation containing the active ingredient in a proportion of 0.001 - 10.0 w/v%, preferably 0.005 - 5.0 w/v%, is applied to one eye several times a day, preferably instilled or applied 1 to 6 times a day.

According to the present invention, a macrolide compound, which is an active ingredient, can be administered alone or in combination with other pharmacologically active components. When administered after formulating a preparation, it can be administered as a preparation

produced by a conventional method. The dosage form may be, for example, eye drop, eye ointment, powder, granule, tablet, capsule, injection, ointment and the like, with particular preference given to eye drop and eye ointment. Such preparation can be produced according to a conventional method. Of such preparations, an oral preparation is preferably a solid solution preparation produced in the same manner as in the preparation of EP-A-0240773. When an eye drop is desired, an eye drop as described in EP-A-0406791 is preferable. When desired, additives generally used for eye drop, such as isotonizing agent (e.g., sodium chloride), buffering agent (e.g., boric acid, disodium hydrogenphosphate, sodium dihydrogenphosphate and the like), preservative (e.g., benzalkonium chloride, benzetonium chloride, chlorobutanol and the like), tackifier [e.g., sugar (lactose, mannitol, maltose and the like), hyaluronic acid or salt thereof (sodium hyaluronate, potassium hyaluronate and the like), mucopolysaccharide (e.g., chondroitin sulfate and the like), sodium polyacrylate, carboxy vinyl polymer, crosslinked polyacrylate, and the like] may be added. The contents of the above references in this respect are hereby incorporated into the specification by reference.

The present invention is explained in more detail in the following by referring to Examples. The present invention is not limited to these examples.

Examples

Example 1

Using FK506 as the active ingredient in the present invention, a 0.06% eye drop (suspension) having the following formulation was used as a test drug.

Test drug

A suspension having the following formulation was produced in the same manner as in EP-A-0406791 (Example 6).

FK506	0.6 mg
polyvinyl alcohol	7.0 mg
disodium hydrogenphosphate 12 hydrate	0.05 mg
sodium dihydrogenphosphate 2 hydrate	0.76 mg
phosphoric acid	appropriate amount
sodium hydroxide	appropriate amount
sodium chloride	8.56 mg
benzalkonium chloride	0.1 mg
injectable water	appropriate amount
Total amount	1 ml

The above-mentioned test drug was consecutively administered twice a day for two weeks to a male (44 years old) having subjective symptoms of dry eye (sense of dryness, foreign body and grittiness) and, as a result, the subjective symptoms disappeared.

From the above result, the test drug was confirmed to be effective for the improvement of subjective symptoms of dry eye.

Example 2

A suspension having the same formulation as in Example 1 was produced using FK506 as the active ingredient to give a 0.01% FK506 eye drop (suspension) and 0.1% FK506 eye drop (suspension) as test drugs. The base for the eye drops was used as the control drug.

The above-mentioned test drugs and the control drug were instilled four times a day for 7 days to 18 healthy subjects (6 per group) at 8:00, 11:00, 14:00 and 17:00.

The tear film breakup time (sec) of the right eye was measured before instillation and 8 days after instillation. The difference between before and after the instillation was calculated, and taken as the mean variation of the tear film breakup time.

The tear film breakup time was measured according to the conventional method. After instillation of fluorescein, the tear film was formed on the surface of the eye by nictitation. The surface of the eye was observed with a microscope without allowing nictitation, and the time until breakage of the tear film (burst by surface tension) was measured. The results are shown in Table 1.

Table 1

Group	Mean variation of tear film breakup time (sec)
Control drug group	+0.17
0.01% FK506 eye drop group	+0.58
0.1% FK506 eye drop group	+0.75

From the above results, the test drug was confirmed to be effective for the improvement of the tear film breakup time, which is one of the tests for lacrimal fluid evaluation of dry eye.

Industrial applicability

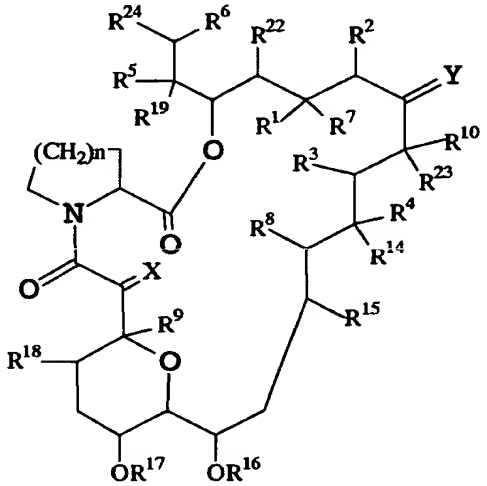
The treatment agent of the present invention, which comprises a macrolide compound as an active ingredient, has a superior improving effect on dry eye, particularly subjective symptom of dry eye and in lacrimal fluid evaluation such as tear film breakup time and the like. Therefore, the treatment agent of the present invention is suggested to be useful as an agent for treating dry eye.

This application is based on application No. 60/132,009 filed in United States of America, the content of which is incorporated hereinto by reference.

CLAIMS

1. An agent for treating a dry eye, comprising a macrolide compound as an active ingredient.

2. The agent of claim 1, wherein the macrolide compound is a tricyclo compound (I) of the following formula



(I)

wherein

adjacent pairs of R^1 and R^2, R^3 and R^4, and R^5 and R^6 each independently

a) consist of two adjacent hydrogen atoms, wherein R^2 is optionally alkyl, or

b) form another bond between carbon atoms binding with the members of each pair;

R^7 is hydrogen atom, hydroxy, alkyloxy or protected hydroxy, or may form oxo with R^1;

R^8 and R^9 each independently show hydrogen atom or hydroxy;

R^{10} is hydrogen atom, alkyl, alkenyl, alkyl substituted by one or more hydroxy, alkenyl substituted by one or more hydroxy, or alkyl substituted by oxo;

X is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $-CH_2O-$;

Y is oxo, (hydrogen atom, hydroxy), (hydrogen atom, hydrogen atom), or a group of the formula $N-NR^{11}R^{12}$ or $N-OR^{13}$;

R^{11} and R^{12} each independently show hydrogen atom, alkyl, aryl or tosyl;

R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{22} and R^{23} each independently show hydrogen

atom or alkyl ;

R^{24} is an optionally substituted ring which optionally contains one or more hetero atom(s) ; and

n is 1 or 2,

wherein

Y, R^{10} and R^{23} optionally form, together with the carbon atom they bind with, a saturated or unsaturated 5 or 6-membered heterocyclic group containing nitrogen atom, sulfur atom and/or oxygen atom, the heterocyclic group may be substituted by one or more group(s) selected from the group consisting of alkyl, hydroxy, alkyloxy, benzyl, a group of the formula $-CH_2Se(C_6H_5)$, and alkyl substituted by one or more hydroxy,

or a pharmaceutically acceptable salt thereof.

3. The agent of claim 1 or claim 2, wherein the macrolide compound is FK506.

4. The agent of any of claim 1 to claim 3, which is in the form of a preparation for local administration to the eye.

5. The agent of any of claim 1 to claim 4, which aims at improving tear film breakup time.

6. A method for treating a dry eye, comprising administering an effective amount of a macrolide compound to a subject in need of the treatment of dry eye.

7. Use of a macrolide compound for the production of a pharmaceutical composition for the treatment of dry eye.

INTERNATIONAL SEARCH REPORT

Intern[illegible]al Application No
PCT/JP 00/02756

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K31/436 A61P27/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	YANG, JIHONG ET AL: "Sjogren's syndrome in mice carrying the lprcg gene and the therapeutic efficacy of an immunosuppressive agent FK506" PATHOL. INT. (1999), 49(2), 133-140 , - February 1999 (1999-02) XP000952466 the whole document ---	1-4,6,7
P,X	DATABASE WPI Derwent Publications Ltd., London, GB; AN 2000-038597 XP002150034 YAMANAKA MASAYUKI: "Compositions containing macrolide compounds have high stability and adsorbability." & WO 99 55332 A (FUJISAWA PHARMA CO LTD), 16 November 1999 (1999-11-16) abstract --- -/--	1-4,6,7

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 October 2000	24/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Veronese, A

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	TSUBOTA K: "New approaches to dry-eye therapy" INTERNATIONAL OPHTHALMOLOGY CLINICS,US,LITTLE, BROWN, BOSTON, vol. 34, no. 1, 1994, pages 115-128, XP002120709 ISSN: 0020-8167 * See page 124: paragraph "Cyclosprin A" *	1-4,6,7
X	IWAMOTO H ET AL: "Inhibitory effects of FK506 on the development of experimental allergic/immune-mediated blepharoconjunctivitis in Lewis rats by systemic but not by topical administration." GRAEFES ARCHIVE FOR CLINICAL AND EXPERIMENTAL OPHTHALMOLOGY, (1999 MAY) 237 (5) 407-14. , XP000952455 the whole document	1-4,6,7
X	WO 97 25977 A (CIBA GEIGY AG ;TIEMESSEN HARRY (DE)) 24 July 1997 (1997-07-24) page 14, line 8	1-4,6,7
X	WO 96 31514 A (SANDOZ LTD ;SANDOZ AG (DE); SANDOZ AG (AT); HERSPERGER RENE (CH);) 10 October 1996 (1996-10-10) page 16, last line	1,2,4-7
P,X	WO 00 09109 A (GUILFORD PHARM INC) 24 February 2000 (2000-02-24) claims; example 11	1,4,6,7
A	TSUJIKAWA A ET AL: "TACROLIMUS (FK506) ATTENUATES LEUKOCYTE ACCUMULATION AFTER TRANSIENT RETINAL ISCHEMIA" STROKE,US,AMERICAN HEART ASSOCIATION, DALLAS TX, vol. 29, no. 7, 1998, pages 1431-1438, XP000913599 ISSN: 0039-2499 the whole document	1-7
A	EP 0 532 862 A (UNIV LOUISVILLE RES FOUND) 24 March 1993 (1993-03-24) claims; examples	1-7

-/--

INTERNATIONAL SEARCH REPORT

Intern[illegible]al Application No
PCT/JP 00/02756

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	TABBARA K F ET AL: "DRY EYE SYNDROME" DRUGS OF TODAY / MEDICAMENTOS DE ACTUALIDAD,ES,J.R. PROUS SS.A. INTERNATIONAL PUBLISHERS, vol. 34, no. 5, 1998, pages 447-453, XP000872457 ISSN: 0025-7656 the whole document	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern[illegible]al Application No
PCT/JP 00/02756

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9955332 A	04-11-1999	AU 3537299 A	16-11-1999
WO 9725977 A	24-07-1997	AU 1543497 A	11-08-1997
		CA 2240339 A	24-07-1997
		EP 0874621 A	04-11-1998
		JP 2000503655 T	28-03-2000
WO 9631514 A	10-10-1996	AU 703523 B	25-03-1999
		AU 5645396 A	23-10-1996
		BR 9604808 A	09-06-1998
		CA 2216562 A	10-10-1996
		CZ 9703123 A	14-01-1998
		EP 0819130 A	21-01-1998
		FI 973529 A	25-11-1997
		HU 9801993 A	28-12-1998
		JP 2000505044 T	25-04-2000
		NO 974536 A	01-10-1997
		NZ 307170 A	29-03-1999
		PL 322553 A	02-02-1998
		SK 133997 A	06-05-1998
		US 5925649 A	20-07-1999
WO 0009109 A	24-02-2000	AU 5555799 A	06-03-2000
EP 0532862 A	24-03-1993	AT 133336 T	15-02-1996
		AU 653415 B	29-09-1994
		AU 2035092 A	28-01-1993
		CA 2074641 A	26-01-1993
		CZ 285660 B	13-10-1999
		DE 69207847 D	07-03-1996
		DE 69207847 T	30-05-1996
		DK 532862 T	19-02-1996
		ES 2083030 T	01-04-1996
		HK 1005705 A	22-01-1999
		HU 211218 B	28-11-1995
		IL 102414 A	04-08-1996
		JP 2568962 B	08-01-1997
		JP 5194212 A	03-08-1993
		KR 216768 B	01-09-1999
		MX 9204381 A	01-02-1993
		NZ 243679 A	24-06-1997
		SK 230792 A	08-05-1996
		RU 2048812 C	27-11-1995
		US 5387589 A	07-02-1995
		ZA 9204953 A	28-04-1993

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 09 November 2000 (09.11.00)	
International application No.: PCT/JP00/02756	Applicant's or agent's file reference: 09358
International filing date: 26 April 2000 (26.04.00)	Priority date: 30 April 1999 (30.04.99)
Applicant: UENO, Ryuji	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

06 September 2000 (06.09.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

TAKASHIMA, Hajime
Fujimura Yamato Seimei Bldg.
2-14, Fushimimachi 4-chome, Chuo-ku
Osaka-shi, Osaka 541-0044
JAPON

Date of mailing (day/month/year)
22 August 2001 (22.08.01)

Applicant's or agent's file reference
09358

IMPORTANT NOTIFICATION

International application No.
PCT/JP00/02756

International filing date (day/month/year)
26 April 2000 (26.04.00)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address
TAKASHIMA, Hajime
Yuki Building
3-9, Hiranomachi 3-chome
Chuo-ku, Osaka-shi
Osaka 541-0046
Japan

State of Nationality

State of Residence

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
TAKASHIMA, Hajime
Fujimura Yamato Seimei Bldg.
2-14, Fushimimachi 4-chome, Chuo-ku
Osaka-shi, Osaka 541-0044
Japan

State of Nationality

State of Residence

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
HONDA Masashi

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To:

TAKASHIMA, Hajime
Fujimura Yamato Seimei Bldg.
2-14, Fushimimachi 4-chome, Chuo-ku
Osaka-shi, Osaka 541-0044
JAPON

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year)
22 August 2001 (22.08.01)

Applicant's or agent's file reference
09358

IMPORTANT NOTIFICATION

International application No.
PCT/JP00/02756

International filing date (day/month/year)
26 April 2000 (26.04.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
R-TECH UENO, LTD.
2-4-8, Koraibashi, Chuo-ku
Osaka-shi, Osaka 541-8543
Japan

State of Nationality: JP
State of Residence: JP
Telephone No.: 0727-82-1473
Facsimile No.: 0727-72-2560
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
SUCAMPO AG
Graben 5
CH-6300 Zug
Switzerland

State of Nationality: CH
State of Residence: CH
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Masashi HONDA
Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
09358		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/JP 00/ 02756	26/04/2000	30/04/1999
Applicant		
R-TECH UENO, LTD.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of Invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   USE OF MACROLIDE COMPOUNDS FOR THE TREATMENT OF DRY EYE

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
09358		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP00/02756	26/04/2000	30/04/1999
International Patent Classification (IPC) or national classification and IPC A61K31/436		
Applicant R-TECH UENO, LTD. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
06/09/2000	20.06.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Greif, G Telephone No. +49 89 2399 8659

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/JP00/02756

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-14	as originally filed

Claims, No.:

1-7	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:
   - ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 5; 6 (with respect to IA).

because:

☒ the said international application, or the said claims Nos. 6 (with respect to IA) relate to the following subject matter which does not require an international preliminary examination (*specify*):
see separate sheet

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 5 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-4, 6-7
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-4, 6-7
Industrial applicability (IA)	Yes:	Claims	1-4, 7

No: Claims

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

R It m III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. Claim 6 relates to subject-matter considered by this Authority to be covered by the provisions of Rule 67.1(iv) PCT. Consequently, no opinion will be formulated with respect to the industrial applicability of the subject-matter of these claims (Article 34(4)(a)(I) PCT).

2. Claim 5 is so unclear due to the lack of technical feature (see Item VIII below) that no opinion with respect to novelty, inventive step and industrial applicability could be formulated.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive st p or industrial applicability; citations and explanations supporting such statem nt

1. The present opinion with regard to novelty, inventive step and industrial applicability is being issued under the assumption that the priority is validly claimed.

2. Reference is made to the following documents:

D1: YANG, JIHONG ET AL: 'Sjogren's syndrome in mice carrying the Iprcg gene and the therapeutic efficacy of an immunosuppressive agent FK506' PATHOL. INT. (1999), 49(2), pages 133-140. February 1999 (1999-02)

D2: WO 97 25977 A

D3: WO 96 31514 A

D4: TSUBOTA K: 'New approaches to dry-eye therapy' INTERNATIONAL OPHTHALMOLOGY CLINICS,US,LITTLE, BROWN, BOSTON, vol. 34, no. 1, 1994, pages 115-128, ISSN: 0020-8167

D5: IWAMOTO H ET AL: 'Inhibitory effects of FK506 on the development of experimental allergic/immune-mediated blepharoconjunctivitis in Lewis rats by systemic but not by topical administration.' GRAEFES ARCHIVE FOR

CLINICAL AND EXPERIMENTAL OPHTHALMOLOGY, (1999 MAY) 237 (5) pages 407-14.

3. Novelty (Art. 33(2) PCT

Document **D1** discloses the use of FK506 for the treatment of Sjörgen's syndrome (abstract; p. 134, right column, FK506 treatment; p. 137, left column, Suppression of Sjörgen's syndrome by FK506). **D2** states that FK506 is under clinical investigation for the treatment of Sjörgen's syndrome (p. 124, 3rd paragraph, Cyclosporine A). **D3** discloses the systemic and topical use of FK506 for the treatment of ocular diseases such as allergic conjunctivitis (abstract; Figure 4; p. 413, right column, last paragraph). **D4** describes the use of ascomycin macrolides such as FK-506 for the treatment of keratoconjunctivitis sicca (p. 3, 5th paragraph; p. 14, line 8). The subject-matter of claims 1-4 and 6-7 of the present application is therefore fully disclosed by documents **D1-D4**.

D5 discloses the use of ascomycins for the treatment of keratoconjunctivitis sicca, and destroys novelty of claims 1-2 and 6-7.

4. Industrial applicability

For the assessment of the present claim 1-7 on the question whether they are industrially applicable, no unified criteria exist in the PCT Contracting States. The patentability can also be dependent upon the formulation of the claims. The EPO, for example, does not recognize as industrially applicable the subject-matter of claims to the use of a compound in medical treatment, but may allow, however, claims to a known compound for first use in medical treatment and the use of such a compound for the manufacture of a medicament for a new medical treatment.

Re Item VIII

Certain observations on the international application

The subject-matter of claim 5 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result should be added.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

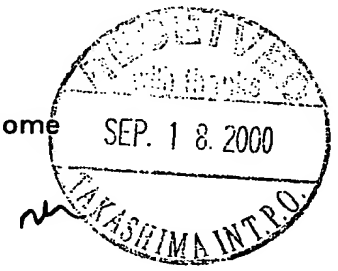
PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

TAKASHIMA, Hajime
Yuki Building
3-9, Hiranomachi 3-chome
Chuo-ku, Osaka-shi
Osaka 541-0046
JAPON



Date of mailing (day/month/year) 01 September 2000 (01.09.00)	
Applicant's or agent's file reference 09358	**IMPORTANT NOTIFICATION**
International application No. PCT/JP00/02756	International filing date (day/month/year) 26 April 2000 (26.04.00)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 30 April 1999 (30.04.99)
Applicant R-TECH UENO, LTD. et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.

3. An **asterisk(*)** appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

4. The **letters "NR"** appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
30 Apri 1999 (30.04.99)	60/132,009	US	11 Augu 2000 (11.08.00)

The Internati nal Bureau of WIPO
34, chemin d s C l mbettes
1211 G neva 20, Switzerland

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Authorized officer

Susumu Kubo

Telephone No. (41-22) 338.83.38

WO 00/66122
PCT/JP00/02756

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:
TAKASHIMA, Hajime
Yuki Building
3-9, Hiranomachi 3-chome
Chuo-ku, Osaka-shi
Osaka 541-0046
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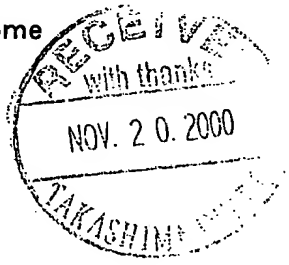

Date of mailing (day/month/year) 09 November 2000 (09.11.00)	
Applicant's or agent's file reference 09358	**IMPORTANT NOTICE**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/JP00/02756	26 April 2000 (26.04.00)	30 April 1999 (30.04.99)

Applicant
R-TECH UENO, LTD. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AL,BR,CA,CN,CZ,EP,HU,IL,IN,JP,LT,LV,MK,MX,NO,NZ,RO,RU,SI,TR,ZA

   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   09 November 2000 (09.11.00) under No. WO 00/66122

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the pri rity date, **a demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The Int rnati nal Bureau of WIPO
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1211 Geneva 20, Switz rland

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Authorized officer
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Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

Dat of mailing (day/month/year)	IMPORTANT NOTICE
09 November 2000 (09.11.00)	
Applicant's or agent's file reference	**International application No.**
09358	PCT/JP00/02756

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments n r a declaration that the applicant does not wish to make amendments.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 00/02756

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K31/436 A61P27/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	YANG, JIHONG ET AL: "Sjogren's syndrome in mice carrying the lprcg gene and the therapeutic efficacy of an immunosuppressive agent FK506" PATHOL. INT. (1999), 49(2), 133-140 , - February 1999 (1999-02) XP000952466 the whole document ---	1-4,6,7
P,X	DATABASE WPI Derwent Publications Ltd., London, GB; AN 2000-038597 XP002150034 YAMANAKA MASAYUKI: "Compositions containing macrolide compounds have high stability and adsorbability." & WO 99 55332 A (FUJISAWA PHARMA CO LTD), 16 November 1999 (1999-11-16) abstract --- -/--	1-4,6,7

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 October 2000	24/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Veronese, A

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 00/02756

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	TABBARA K F ET AL: "DRY EYE SYNDROME" DRUGS OF TODAY / MEDICAMENTOS DE ACTUALIDAD,ES,J.R. PROUS SS.A. INTERNATIONAL PUBLISHERS, vol. 34, no. 5, 1998, pages 447-453, XP000872457 ISSN: 0025-7656 the whole document	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 00/02756

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	TSUBOTA K: "New approaches to dry-eye therapy" INTERNATIONAL OPHTHALMOLOGY CLINICS,US,LITTLE, BROWN, BOSTON, vol. 34, no. 1, 1994, pages 115-128, XP002120709 ISSN: 0020-8167 * See page 124: paragraph "Cyclosprin A" * ---	1-4,6,7
X	IWAMOTO H ET AL: "Inhibitory effects of FK506 on the development of experimental allergic/immune-mediated blepharoconjunctivitis in Lewis rats by systemic but not by topical administration." GRAEFES ARCHIVE FOR CLINICAL AND EXPERIMENTAL OPHTHALMOLOGY, (1999 MAY) 237 (5) 407-14. , XP000952455 the whole document ---	1-4,6,7
X	WO 97 25977 A (CIBA GEIGY AG ;TIEMESSEN HARRY (DE)) 24 July 1997 (1997-07-24) page 14, line 8 ---	1-4,6,7
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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